PUGET SOUND

COMPREHENSIVE CHINOOK MANAGEMENT PLAN:

HARVEST MANAGEMENT COMPONENT

Puget Sound Indian Tribes

And

Washington Department of Fish and Wildlife

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1 Introduction

Recovery of the productivity, abundance and diversity of salmon will require successful management of all factors affecting salmon life history. This "gravel to gravel" management must address freshwater, estuarine and marine habitats, interactions with predators, prey and hatchery fish, as well as management of harvest. This document is the harvest management component of the Comprehensive Chinook Management Plan.

It is the goal of the Parties to protect, restore, and enhance the productivity, abundance, and diversity of Puget Sound chinook salmon and their ecosystems to sustain ceremonial, subsistence, commercial, and recreational fisheries, non-consumptive fish benefits and other cultural and ecological values. Achievement of this goal requires that harvest be constrained within limits appropriate to the productivity of each stock. Harvest management must work in concert with habitat protection and restoration, as well as artificial production, in order to attain the necessary spawners and rates of recruits per spawner to achieve this goal.

Ultimately, success of the Comprehensive Chinook Management Plan includes restoring populations to levels that provide meaningful harvest on a sustained basis. In the near term, as comprehensive recovery activities in habitat and hatcheries are being implemented, fisheries will be managed to ensure that mortalities (catch and incidental) will not impede progress toward recovery. Fishery exploitation rates on depressed Puget Sound chinook management units will be kept at or below targeted levels (Table 6).

This harvest management plan defines harvest objectives for chinook salmon originating in Washington waters from the mouth of the Strait of Juan de Fuca eastward (Puget Sound). This geographic scope encompasses the area defined by the Puget Sound Evolutionarily Significant Unit (ESU), as established by the National Marine Fisheries Service (NMFS) (Myers et al. 1998), as well as the western Strait of Juan de Fuca. Harvest objectives specified in this plan account for fisheries-related mortality throughout the migratory range of Puget Sound chinook – from Oregon to Southeast Alaska.

The goals and objectives outlined within this plan guide the management of Puget Sound chinook as they transit various management jurisdictions. Intercepting fisheries in Alaska and British Columbia are managed in compliance with the Pacific Salmon Treaty (PST) (PST 1999). Ocean fisheries off the coasts of Washington and Oregon are managed in compliance with the Magnuson-Stevens Act (1996) by the Secretary of Commerce. The State of Washington and treaty Indian tribes manage fisheries within Puget Sound pursuant to the Puget Sound Salmon Management Plan (PSSMP 1985).

The following general principles guide the details of the plan:

- All individual populations of chinook must be considered in assessing the achievement of the plan's objective. Populations may be combined into management units for the assessment of impacts (See Table 1).

- All sources of fishery related mortality, including landed and non-landed, incidental and directed, are included in assessing total exploitation rates. All mortality will be expressed in terms of adult equivalent mortality.

- Harvest management will consider size, age or sex selectivity in fisheries to maintain or restore the diversity and productivity of chinook populations.

- Conservation actions shall be shared fairly.

- This plan shall comply with U.S. v. Washington (384 F. Supp. 312 (W. D. WASH. 1974)) and other applicable federal court orders.

- The plan shall be updated and modified as additional information becomes available and outcomes of management measures are evaluated against expectations. Because success of this management plan will require improving knowledge regarding the productivity of the populations and capacity of habitat for chinook salmon.

Table 1. Natural chinook salmon management units comprising the Puget Sound ESU.

1.1.1 Management Unit	**Populations**
1.1.1.1 Nooksack River Early	North Fork Nooksack*, South Fork Nooksack
1.1.1.2 Skagit River Spring	Upper Sauk R, Suiattle R, Upper Cascade R
1.1.1.3 Skagit RiverSummer/Fall	Upper Skagit summer , Lower Sauk summer, Lower Skagit fall
1.1.1.4 Stillaguamish R. Summer/Fall	***1.1.1.5 Stillaguamish summer*, Stillaguamish fall***
1.1.1.6 Snohomish River Summer/Fall	***1.1.1.7 Snohomish summer, Wallace River sum/fall, Snohomish fall, Bridal Veil Creek fall***
1.1.1.8 Lake Washington Summer/Fall	North Lake Washington Tribs., Cedar River
1.1.1.9 Green River Summer/Fall	***1.1.1.10 Green River, Newaukum Creek***
1.1.1.11 White River Spring	***1.1.1.12 White River ****
1.1.1.13 Puyallup River Summer/Fall	***1.1.1.14 Puyallup River***
1.1.1.15 Nisqually River Summer/Fall	***1.1.1.16 Nisqually composite.***
1.1.1.17 Mid Hood Canal Summer/Fall	***1.1.1.18 Dosewallips R, Duckabush R, Hamma Hamma R***
1.1.1.19 Skokomish River Summer/Fall	***1.1.1.20 Skokomish natural/hatchery composite***
1.1.1.21 Dungeness River	***1.1.1.22 Dungeness****
1.1.1.23 Elwha River	***1.1.1.24 Elwha****
1.1.1.25 Western Strait	***1.1.1.26 Hoko River***

* Hatchery production listed as essential to recovery

2 POPULATION STRUCTURE

In terms of evolutionary legacy, Puget Sound chinook stocks comprise a distinct group of chinook salmon (Myers et al. 1998). Ecologically this region is classified as the Puget Sound Ecoregion, a physiographic classification based on soil content, topography, climate, vegetation, and land use (Omernik and Gallant 1986). The Puget Sound Ecoregion is situated between the Coast Range and Cascade Range Ecoregions and experiences reduced rainfall (50-120cm) due to the rainshadow effect of the Olympic Mountains. The vegetation type is primarily a Douglas fir subclimax forest, with other coniferous species locally abundant. The NMFS utilized this habitat delineation in defining the boundaries of the ESU.

Chinook salmon originating from Puget Sound generally exhibit an ocean-type (i.e., sub-yearling smolt emigration) life history, although some populations also exhibit a stream-type (i.e., yearling smolt emigration) life history. Puget Sound chinook mature at 3 to 6 years of age, though the majority of adult returns are comprised of 3 and 4 year olds. Ocean migration patterns are coastally oriented, extending from northern California to southeast Alaska, however Puget Sound stocks are harvested primarily by marine fisheries in British Columbia and Puget Sound.

Both genetic and environmental factors influence phenotypic diversity within and between salmon populations. Puget Sound chinook salmon are genetically distinct and are uniquely adapted to the local environments of the Puget Sound Ecoregion. Retention of the characteristics distinct to Puget Sound chinook depends upon maintaining healthy and diverse populations within the region, and habitat characteristics to which these salmonid populations are adapted.

The spatial and temporal distribution of wild or natural spawning populations of chinook currently within Puget Sound has been described by the co-managers within the Salmon and Steelhead Stock Inventory (SASSI) (WDF et al. 1993). SASSI inventoried natural reproducing populations of salmon and steelhead regardless of origin (including native, non-native, and mixed parentage). The aggregation of populations into management units of natural production was based on the SASSI delineation of Puget Sound "stocks" (Table 2).

For fishery management purposes, some populations are aggregated into management units for the purpose of evaluating spawning escapement, exploitation rate, or other management objectives. Under the Puget Sound Salmon Management Plan (PSSMP) a management unit is defined as:

> "A stock or group of stocks which are aggregated for the purpose of achieving a desired spawning escapement objective."

Table 2 - Puget Sound SASSI Stocks and Corresponding Natural Management Units in the Harvest Management Plan

River Basin - SASSI Stocks	**Management Unit** - Populations
Nooksack/Samish - NF Nooksack - SF Nooksack - Samish/MS Nooksack Fall (non-native)	**Nooksack Early** - NF Nooksack - SF Nooksack
Skagit - Upper Sauk Spring - Suiattle Spring - Upper Cascade Spring - Lower Sauk Summer - Upper Skagit MS/Tribs. Summer - Lower Skagit MS/Tribs. Fall	**Skagit Spring** - Upper Sauk Suiattle Upper Cascade **Skagit Summer/Fall** Lower Sauk Summer Upper Skagit Summer Lower Skagit Fall
Stillaguamish Summer Fall	**Stillaguamish Summer/Fall** - Summer Fall
Snohomish - Snohomish Summer Wallace R. Summer/Fall Snohomish Fall Bridal Veil Cr. Fall	**Snohomish** - Snohomish Summer Wallace R. Summer/Fall Snohomish Fall Bridal Veil Cr. Fall
Lake Washington - Cedar River No. L. Washington Tribs. Issaquah (non-native)	**Lake Washington Summer/Fall** N. Lake Wash. Tribs Cedar River
Duwamish/Green - Duwamish/Green Newaukum Creek	**Green Summer/Fall** - Green Newaukum Creek
Puyallup - White River Spring White (Puyallup) Summer/Fall Puyallup Fall	**White River** Spring **Puyallup –** summer fall
Nisqually- Summer/Fall	**Nisqually** – fall
South Sound Tributaries	No historical evidence of sustainable chinook salmon production in these systems. Current production assumed to originate from off station plants or strays.
Hood Canal - Hood Canal Summer/Fall	**Mid-Hood Canal** - Dosewallips Duckabush Hamma Hamma **Skokomish** -natural/hatchery aggregate
Strait of Juan de Fuca - Dungeness Spring/Summer - Elwha/Morse Cr. Summer/Fall - Hoko Fall	**Dungeness** **Elwha** **Western Strait** -Hoko

The PSSMP defines “stock” as:

> "An anadromous salmonid population of a single species migrating during a particular season to a specific fish production facility and/or to a freshwater system which flows into saltwater."

Under the PSSMP, an escapement objective is not established for a unit smaller than a system that flows into saltwater (i.e., freshwater tributaries within a system could not produce different natural management units), unless there is a seasonal difference in migration timing (e.g., spring vs. summer/fall chinook) or unless the co-managers agree otherwise. All populations are considered in the development and assessment of a management unit objective. Under this plan, exploitation rate objectives are derived at the management unit level and represent the weighting of the combined populations' productivity. Exploitation rates are limited to levels that will not impede recovery on a management unit basis and will be achieve in a manner that will not significantly reduce the probability the component populations will recover. In many cases, data are not sufficient for accurately estimating productivity and exploitation rates associated with recovery, maximum sustained harvest (MSH), or maximum sustained yield (MSY) for individual populations within a management unit.

Fifteen management units represent natural chinook production within Puget Sound (Table 1). Diversity within each management unit is recognized with the identification of its associated populations. The specific goals (Table 6) and management considerations for each Puget Sound natural chinook management unit and their associated populations are found in the Management Unit Profiles (Appendix A).

Management units provide the appropriate level of aggregation to restore and preserve the health and diversity of Puget Sound chinook. This is the lowest level of population structure that possesses comparable demographic data across the region and is the level at which impact modeling occurs for the purpose of harvest management planning. The management units generally include populations within river systems or regions that share similar phenotypic, geographic, and habitat characteristics. Within a river system, management units include populations with very similar demographics, life history traits, and productivity (WDF et al. 1993). An exception to the general rule of one management unit per river system occurs in rivers where there is at least one population with early ("spring") run timing and at least one with later ("summer", "fall", or "summer/fall") timing. In these systems, the spring populations are usually aggregated separately from the other populations in recognition of the differences in run timing, life history, preferred habitat, and productivity between these two categories.

The fifteen natural management units identified in this plan represent the full complement of the natural chinook populations within Puget Sound and include all principal life history traits (spring, summer and fall runs). Managing for the current array of natural management units preserves the spatial and temporal distribution of natural chinook runs throughout the region. The intent of the plan is to provide for the conservation of each natural management unit, which in turn conserves the region's diversity of life history

and genetic traits. Maintenance of these management units as aggregates of healthy, self-sustaining populations will ensure the diversity necessary for continuing the long-term productivity of Puget Sound chinook salmon, thereby, conserving the evolutionary legacy of the Puget Sound ESU for chinook salmon as a species.

3 MANAGEMENT UNIT STATUS

Many Puget Sound chinook natural management units have been chronically below desired spawning escapement levels for nearly twenty years. Natural management units have been the focus of rebuilding programs under the Pacific Salmon Treaty (PST) since 1985, as well as local and regional efforts undertaken by state and tribal co-managers. Pursuant to the Magnuson Act, the Pacific Fisheries Management Council (PFMC) analyzed the causes for failure of several management units to meet their escapement goals (PSSSRG 1992 and 1997). In 1996, NMFS undertook a coast-wide assessment of chinook salmon in response to several petitions to consider individual populations for listing under the ESA. NMFS found that the listing of Puget Sound chinook was warranted based on concerns regarding risks associated with population trends and productivity stemming from the degradation and loss of freshwater and estuarine habitat, historical harvest rates, and hatchery practices (NMFS 1999). Chinook in the Puget Sound ESU were listed as threatened effective May 24, 1999.

Recent spawning escapement levels for Puget Sound chinook have varied with some management units above and some below their established goals (Table 3). These spawning escapement goals have served as the long-term objectives for these management units and are presented here to evaluate escapement levels from 1979 to the present[1]. Despite generally decreasing exploitation rates on Puget Sound chinook since the implementation of the Pacific Salmon Treaty in 1985 (Fig. 1), spawning escapement trends have remained relatively constant (Fig. 2).

[1] These spawning escapement goals will be reassessed in the development of recovery goals for Puget Sound Chinook.

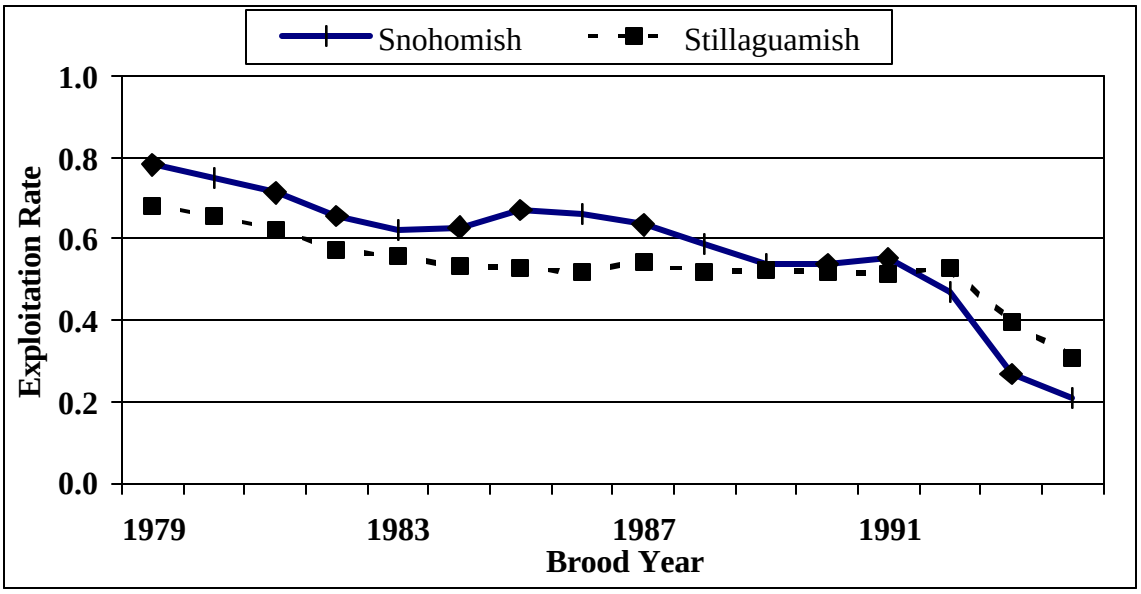

Figure 1. Exploitation rates for Stillaguamish and Snohomish management units, 1979-1994 brood years (CTC chinook model, pers. comm. Dell Simmons, NMFS).

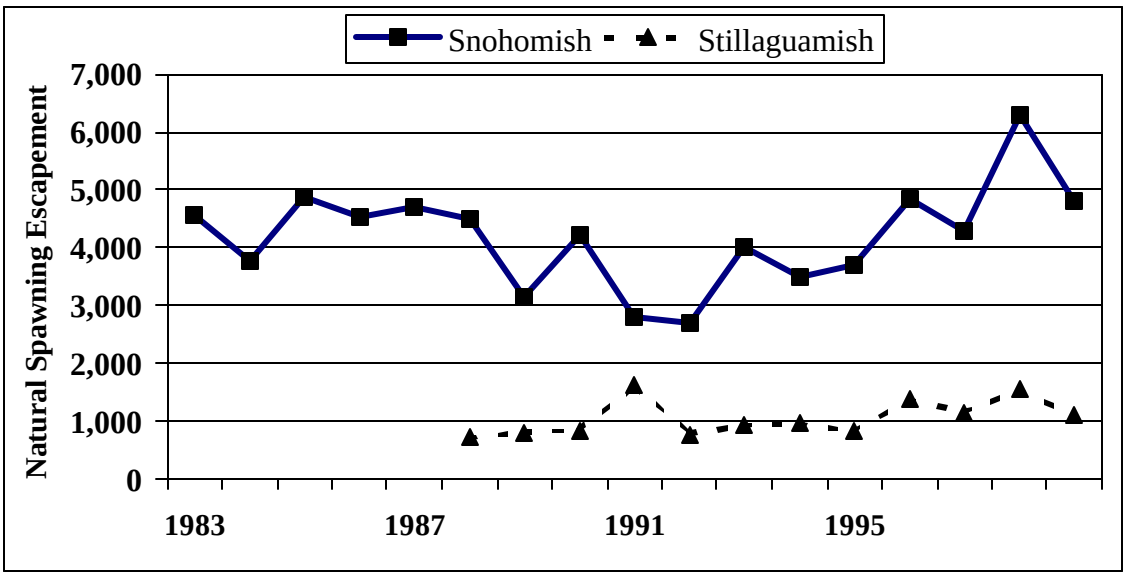

Figure 2. Annual natural spawning escapements for the Stillaguamish River and Snohomish River management units.

The trend in spawning escapement can be assessed by

$$= \text{geometric mean of } N_t/N_{t-1},$$

computed at each year, t. Values of lambda greater than 1.0 indicate time series that are not decreasing. For the 12-year period 1988 through 1999, lambda is 1.040 for the Stillaguamish management unit and 1.006 for the Snohomish, indicating non-decreasing escapements.

Because exploitation rates have decreased, the spawning escapement is not an accurate indicator of the temporal trend in recruitment of adults. A simple reconstruction of total abundance can be computed from the time series of escapement and exploitation rate. An example of adult recruitment compared with escapement for the Snohomish management unit (Fig. 3) shows that the recruitment declining despite the stable or increasing escapement.

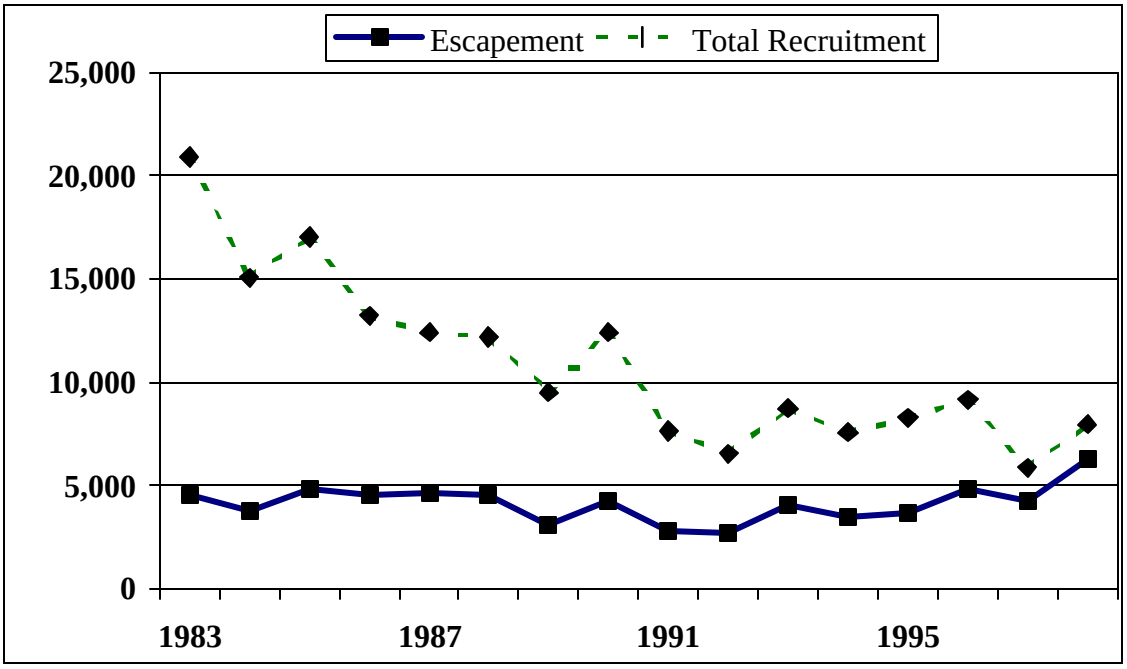

Figure 3. Comparison of time series of escapement and total adult recruitment for Snohomish chinook.

For the 11 years 1988 through 1998 the estimate of trend in the recruitment time series is lambda = 0.959. This number is less than 1, indicating a declining series, and less than the same statistic for the escapement time series (1.034 for 1988 through 1998), indicating a strong decrease in recruitment relative to escapement. This shows that a strong decline in recruitment has been largely compensated for by decreases in harvest.

One means of evaluating stock status from these data is a comparison to the threshold defined by NMFS that determines an "overfished[2]" stock relative to National Standards of the Magnuson-Stevens Act (NMFS 1998b). Under this approach the minimum stock

[2] Under the Magnuson-Stevens Act, "overfished" is defined to describe any stock or stock complex whose size is sufficiently small that a change in management practices is required in order to achieve an appropriate level and rate of rebuilding.

Table 3. Spawning escapements for Puget Sound natural chinook management units. Estimates for 2000 are preliminary.

Management Unit	Goal[1]	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Nooksack early	**4000**[2]	**685**	**906**	**152**	**472**	**596**	**681**	**158**	**518**	**741**	**801**	**523**	**1124**	**1518**
North Fork	2000[2]	452	300	10	107	493	446	45	228	538	621	366	911	1235
South Fork	2000[2]	233	606	142	365	103	235	118	290	203	180	157	213	283
Skagit spring	**3000**[3]	**2064**	**1515**	**1592**	**1552**	**1001**	**788**	**899**	**2020**	**1728**	**581**	**1086**[3a]	**471**[3a]	**1021**[3a]
Skagit sum / fall	**14900**[4]	**11954**	**6776**	**17206**	**6014**	**7671**	**5916**	**6231**	**7155**	**12025**	**4999**	**14609**	**4924**	**16930**
Stillaguamish S/F	**2000**[4]	**717**	**811**	**842**	**1632**	**780**	**928**	**954**	**822**	**1384**	**1153**	**1544**	**1098**	**1643**
Snohomish S/F	**5250**[4]	**4513**	**3138**	**4209**	**2783**	**2708**	**3866**	**3626**	**3176**	**4851**	**4292**	**6304**	**4799**	**6092**
Lake Washington														
Cedar River	1200[5]	559	558	469	508	525	156	452	681	303	227	432	241	120
Green R. Fall	**5800**[4]	**7994**	**11512**	**7035**	**10548**	**5267**	**2476**	**4078**	**7939**	**6026**	**9967**	**7312**	**9100**	**6170**
White R. spring	**1000**[6]	**127**	**83**	**275**	**194**	**406**	**409**	**392**	**605**	**628**	**402**	**316**	**553**	**1523**
Puyallup fall		**1332**	**2442**	**3515**	**1702**	**3034**	**1999**	**2526**	**2701**	**2444**	**1554**	**4995**	**1986**	**1193**
South Prairie	500[7]													
Nisqually fall	**1100** [8]	**1342**	**2332**	**994**	**953**	**106**	**1655**	**1730**	**817**	**606**	**340**	**834**	**1399**	**---**
Mid Hood Canal	**750**[9]	**127**	**113**	**45**	**86**	**96**	**142**	**384**	**103**	**24**	**6**	**287**	**873**	**438**
Skokomish	**3150**[10]	**5796**	**3760**	**2828**	**4787**	**1119**	**1572**	**1152**	**6594**	**4095**	**2337**	**6911**	**10044**	**4876**
Dungeness	**925**[11]	**335**	**88**	**310**	**163**	**153**	**43**	**65**	**163**	**183**	**50**	**110**	**75**	**218**
Elwha River	**2700**[12]	**7873**	**5487**	**3180**	**3469**	**3859**	**1569**	**1546**	**1812**	**1875**	**2527**	**2409**	**1606**	**2074**
Western Strait														
Hoko	850[13]	784	845	493	1008	741	894	429	929	1266	1184	1213	1550	700

[1] These spawning escapement goals have been used as the long-term goals and are presented here to evaluate escapement levels from 1988 to the present.
[2] Nooksack Endangered Species Action Team 2000. These numbers reflect natural origin spawners.
[3] Washington Department of Fisheries 1977. These estimates are generated from redd counts versus earlier estimates which are extrapolated from peak live and dead counts.
[4] Ames and Phinney 1977.
[5] Hage et al. 1994.
[6] WDFW et al. 1996. Interim goal, represents 1,000 natural spawners passed over Mud Mountain Dam.
[7] Puyallup River Fall Chinook Recovery Plan – *in preparation*. Escapement estimates are based on redd counts in even-numbered years and AUC estimations converted to redd-based projections in odd-numbered years due to pink salmon spawning.
[8] U.S. v. Wash. Civil 9213, Ph. I (Proc. 83-8). Order Re: Hood Canal ManagementPlan (1986).
[9] Ames and Phinney 1977. This represents a composite goal, a targeted hatchery return of 1500 adults is now included.
[10] Smith and Sele 1994.
[11] Ames and Phinney 1977. This objective is a composite escapement of natural and hatchery returns. Hatchery is listed as essential to recovery.
[12] Ames and Phinney 1977. Original goal modified to exclude capture of adults for supplementation program.

size threshold for salmon to determine an "overfished" stock is the ½ MSY stock size (i.e. MSY spawning escapement). By this standard the majority of Puget Sound chinook management units are above the minimum stock size threshold established to define "overfished" stocks (Table 4). Six natural management units fall below this threshold: Nooksack early; Skagit spring; Lake Washington; White River spring; Mid-Hood Canal; and Dungeness. This cursory assessment is a conservative estimate of stock status given that spawning escapement goals established to maximize habitat utilization are generally greater than MSY spawning escapement based goals (Varanasi 1999).

Table 4. Comparison of Recent Spawning Escapements to National Standard Guidelines

Natural Chinook **1.1.2 Management Units**	Threshold for "Overfished" Stock[1] (50% of Goal)	Recent Spawning Geometric Mean 1996-1999	Comparison Relative to Threshold	
			Recent Mean	Frequency achieved
Nooksack Early	2000	795	***1.1.2.1***	0 / 4
Skagit Spring Chinook	1500	846	Below	1 / 4
Skagit Summer/Fall Chinook	7450	8109	Above	2 / 4
Stillaguamish Summer/Fall	1000	1282	Above	4 / 4
Snohomish Summer/Fall	2650	5010	Above	4 / 4
Lake Washington Chinook Cedar River Index	600	291	Below	0 / 4
Green River Chinook	2900	7951	Above	4 / 4
White River Spring Chinook	500	458	Below	2 / 4
Puyallup River Chinook	1625	2477	Above	3 / 4
Nisqually River Chinook	550	700	Above	3 / 4
Mid-Hood Canal	375	77	Below	1 / 4
Skokomish	1575	5077	Above	4 / 4
Dungeness	463	93	Below	0 / 4
Elwha River	1350	2069	Above	4 / 4
Western Strait Hoko	425	1296	Above	4 / 4

[1] Current spawning escapement goals are used as surrogates for MSY spawning stock size.

Another means of evaluating stock status is the comparison of recent spawning escapement to earlier established benchmarks. Spawning escapement since Myers et al. (1998) indicates that 11 out of 15 management units are either stable or have improved relative to the benchmark (1992-96) utilized in that assessment (Table 5). The other four management units' (Skagit summer/fall, Lake Washington, White River spring, and Dungeness) 1997-1999 geometric means are less than the 1992-1996 benchmark. The

upswing in escapement for the majority of the management units is encouraging. However, since much of the additional escapement may have resulted form the near elimination of most fisheries, it is too soon to determine if this represents the beginning of sustained improvement in Puget Sound chinook production.

Table 5. Comparison of Recent Spawning Escapements to Short and Long-Term Averages

Natural Chinook 1.1.3 Management Units	**Spawning Escapement Geometric Means** [1] A **1988-1996**	B **1992-1996**	C **1997-1999**	**Ratio of Column C to B** [2]
Nooksack Early				
North Fork	240	261		2.3
South Fork	592			1.0
	210	176		
	182			
Skagit Spring Chinook [3]	NA	799		1.1
	811			
Skagit Summer/Fall Chinook	8043	7537		0.9
	7111			
Stillaguamish Summer/Fall	1017	953		1.3
	1251			
Snohomish Summer/Fall	3906	3576		1.4
	5064			
Lake Washington Chinook				
Cedar River Index	393	377	287	0.8
Green River Chinook	6894	4799		1.8
	8721			
White River Spring Chinook	316	477	413	0.9
Puyallup River Chinook	2363	2518	2489	1.0
Nisqually River Chinook	866	684	735	1.1
Mid-Hood Canal	101	105	115	1.1
Skokomish	3426	2227	5454	2.4
Dungeness	119	105	74	0.7
Elwha River	2697	1998	2138	1.1
Western Strait Hoko	889	803	1306	1.6

[1] Geometric means were utilized to enable comparison with the analysis in the Status Review of Chinook Salmon (Meyers et al. 1998)
[2] This ratio compares mean escapement for the most recent years with the preceding five years.
[3] For this analysis Skagit spring escapements for 1992-99 were derived from redd counts. Column A, cited in the Status Review, was based on a different escapement methodology.

Overall, these assessments indicate that, while most management units of spring and summer/fall chinook currently are well below their targeted production levels, recent spawning escapement levels have generally been above NMFS' "overfished" threshold, and recent trends are positive for the majority of the Puget Sound chinook management units. Primarily this has been achieved through reduction in harvest, embodied by the the transition to exploitation based management in 1997 (Figures 3). The intent of the

Comprehensive Chinook Management Plan is to continue to manage with this approach to ensure that fishery mortality does not impede progress toward recovery.

4 RECOVERY GOALS

The co-managers are quantifying productivity, abundance, and diversity recovery goals for each Puget Sound chinook population. When completed, these goals will guide recovery efforts and provide a standard to measure progress towards recovery. The ecosystems associated with each natural management unit are being evaluated under both historical conditions and under Properly Functioning Conditions (PFC) for habitat the NMFS has defined as necessary for the long-term survival of a species. Analyses are being done to quantify the productivity, abundance, and diversity of a management unit associated with PFC and with historical conditions.

Specific goals will be established for each Puget Sound chinook management unit and its associated populations. The abundance goals, where data exists, will be expressed as freshwater smolts, adult returns, and return year spawning escapement reflecting of the capacity or MSY level of the associated ecosystem. Productivity goals will be expressed as spawner to smolt survival rates and adult recruits per spawner. Diversity goals will be expressed as a percentage of life history variants that are viable (i.e., with greater than 1:1 recruit to spawner ratio on the average), desired spawner age composition, and spatial/temporal run distribution.

These initial estimates will serve as interim goals given the uncertainties regarding what the productivity and capacity will be with restoration of watershed processes and functions. Improving habitat quality and quantity, and increasing stock productivity is a long-term venture. The quality and quantity of freshwater, estuarine, and early marine habitat are key factors in determining the potential productive capacity of a river system. Until habitat can be restored and estimates of MSY developed consistent with recovered habitat conditions, the ultimate productive capacity for a river system and associated management unit(s) remains unknown. As additional data and experience is gained, adaptive management measures will be applied to refine these recovery goals and associated management efforts.

While recovery goals are ultimately expressed in terms of natural production, achievement of these goals will require achievement of habitat standards that provide sufficient productivity, abundance, and diversity to meet these fish related goals. In many cases, there will be a time lag of many years between achievement of a habitat standard (e.g., stable water flows and stream channel configuration) and achieving the increased fish production that results from application of that habitat standard. Therefore, in order to assess progress toward achieving recovery goals in the short term, it will also be necessary, in addition to measuring fish production, to express recovery goals in terms of habitat standards.

These habitat goals represent the standards that will achieve the productivity, abundance, and diversity goals for chinook recovery. The management unit-specific recovery goals for productivity, abundance, and diversity will be developed based on an analysis of each watershed's physical habitat parameters functioning under optimal conditions.

Consequently, the habitat standards will be set to achieve these conditions within the region's watersheds.

Exploitation rates and spawning escapement objectives in this fishery management plan have been set to facilitate rebuilding toward these recovery levels. For management units with sufficient data, recovery exploitation rates were established based on current survival and productivity rates with adjustments to account for data uncertainty and management imprecision. These exploitation rates are less than the rates that would be appropriate for improved habitat. Thus, these rates turn short-term increases in productivity into additional fish on the spawning grounds. The intent is to increase spawners in concert with the recovery of the system's productivity and capacity resulting from habitat restoration efforts, thereby annually providing sufficient escapement to enable the management unit to generate maximum surplus under progressively improving habitat conditions.

5 MANAGEMENT OBJECTIVES

The basic management strategy is to keep exploitation rates at or below a unit-specific ceiling rate, as long as the unit's spawning escapement is expected to be above the low abundance threshold. Maximum exploitation rate objectives and minimum escapement thresholds are identified for each management unit (Table 6). Exploitation rates provide a consistent measure across all fisheries. The minimum spawning escapement thresholds define a trigger point for implementing additional management action to prevent stock instability.

Table 6- Natural Chinook Management Units and Associated Objectives

Natural Chinook **1.1.4** Management Units	**Recovery Exploitation Rate Ceiling[1] or Escapement Objective**	**Low Abundance Threshold[2]**
Western Strait – Hoko River	10% SUS ER [3]	500 spawners
Elwha River	10% SUS ER [3]	1,000 spawners
Dungeness River	10% SUS ER [3]	500 spawners
Mid-Hood Canal	15% pre-terminal SUS ER [3] Terminal – 750 spawners	400 spawners (n)
Skokomish River	15% pre-terminal SUS ER Terminal – 3,150 aggregate, 1,200 natural spawners	1,300 aggregate, 800 natural spawners
Nooksack River Early North Fork South Fork	The co-managers and NMFS are developing an RER for this stock[4]	 1,000 spawners (n) 1,000 spawners (n)
Skagit River Spring	42% Total ER	576 spawners (n)
Skagit River Summer/Fall	52% Total ER	4,800 spawners (n)
Stillaguamish River	25% Total ER	500 spawners (n)
Snohomish River	32% Total ER	2,000 spawners (n)
Lake Washington Cedar River Index	15% pre-terminal SUS ER Terminal – 1,200 spawners	200 spawners (n)
Green River	15% pre-terminal SUS ER Terminal – 5,800 spawners	1,800 spawners
White River Spring	17% Total ER	200 spawners
Puyallup River	50% Total ER	500 spawners
Nisqually River	Terminal - 1,100 spawners	500 spawners

(n) – low abundance measured as natural origin recruits

[1] Interim management ceiling during recovery phase expressed in FRAM values.

[2] Level of forecasted spawning abundance that triggers additional management action as defined in Step 5 of the Application Section. Thresholds are set with consideration to stock-specific characteristics and genetic viability concerns (See Appendix A for details by management unit).
[3] FRAM exploitation rate measured as total exploitation rate in southern U.S. fisheries. This objective represents the average exploitation rate by southern United States fisheries during 1992-1996 determined from run reconstruction.
[4] In the interim, management will be guided by applying Appendix C.

The status of the management unit determines the specific management objective utilized. Southern U.S. fisheries will be managed not to exceed recovery exploitation rate ceilings as noted in Table 6, unless the projected spawning level is below a management unit's low abundance threshold. In that case, additional management action may be taken to meet or exceed the low abundance threshold or to maximize the spawning escapement given the maximum regulatory effect that can be achieved for the management unit.

Approach

For each management unit, exploitation rate objectives are developed that reflect the current productivity of its associated populations. For management units that comprise the most abundant sources of natural production in Puget Sound the exploitation rate analyses of freshwater and marine survival, and the relationship between spawner and recruits defined their objectives. The future dynamics of the management unit was considered by simulating production for a 25-year period, with abundance of each successive generation determined by applying a randomly selected survival value from the recent historical estimates. This simulation was iterated 1,000 to 2,000 times for each total exploitation rate, across the range from 0 percent to 60 percent. Management error associated with the fisheries model (FRAM) used in pre-season planning is also factored into the population simulation. The probability, at each exploitation rate, of the management unit recovering or falling below the critical threshold of abundance was computed from the resulting set of simulations. Co-managers selected a maximum exploitation rate that represents a high probability of recovery.

This described analysis, requires an extensive data set that accurately portrays the historical harvest and spawning escapement of a management unit or its associated populations. The coded-wire tagging has provided harvest data for the Skagit summer/fall and spring, Stillaguamish summer, and Snohomish summer/fall management units by the co-managers. Analyses specific to the derivation of recovery exploitation rates for these management units (Table 6) are detailed in the status profiles (Appendix A).

Exploitation rate objectives developed from productivity data are risk averse. The chosen recovery exploitation rate objectives insure that harvest will not significantly reduce the probability that the management unit will recover. Harvest at the targeted exploitation rate:

- will not increase the probability of the management unit falling below the critical abundance threshold, in 25 years, by more than 5 percentage points than if the exploitation rate were modeled as zero;

- assures an 80% probability of the management unit exceeding the recovery escapement level[3] in 25 years.

The simulation model accounts for the influence of management error that, in some years, will result in an actual exploitation rate deviating from the pre-season expectation. Further risk aversion is incorporated in developing of the exploitation rate objectives with the use of current survival rates. Freshwater and marine survival has been relatively low for the past ten years in comparison to earlier time series. The simulation model utilizes this range of low survival in projecting future abundance. This is risk averse as productivity will increase if freshwater or ocean conditions improve, but the harvest objective assumes the worst case in this respect.

The development of specific recovery exploitation rates has been limited to management units where spawning escapement and coded-wire tag data enable cohort reconstruction (i.e., abundance) and derivation of stock / recruit functions. These analyses have been completed for several management units that, first, comprise the majority of natural chinook production in Puget Sound, and in most cases are production units where natural production is greater than hatchery production. These analyzed management units represent the entire range of life history types (races) that comprise the Puget Sound ESU, and a wide range of abundance and productivity. Although the long-term objective of the co-managers is to develop unit-specific harvest objectives, based on understanding of the productivity of the component stocks, at this point units from south Puget Sound, Hood Canal, and the Strait of Juan de Fuca lack the requisite data.

For these management units where adequate data were not available to assess recent productivity, a recent-year or average of recent exploitation rates were adopted as the objective. Directed harvest of Puget Sound chinook has been increasingly constrained in recent years, and, as abundance has continued to decline, further management measures have been introduced to minimize incidental harvest. These increasingly restrictive measures are believed to have resulted in more stable spawning escapement. The recent exploitation rates, as estimated by preseason planning models, afford protection sufficient to prevent the spawning escapement from falling below low abundance thresholds. This approach guides the management for Nooksack early, Puyallup, White River, Mid-Hood Canal, Dungeness, Elwha, and the western Strait of Juan de Fuca management units.

A variation of this approach occurs for management units where terminal fisheries regimes allow in-season assessment of abundance, based on a statistically reliable relationship between catch data and terminal run size. Preseason planning models will be used to determine exploitation rate objectives that will establish an appropriate pre-terminal fishing regime. The terminal fishery will be managed to achieve the desired escapement of natural spawners. This variant on the recent year average approach will guide the management for Lake Washington, Green River, Nisqually River, and Skokomish management units.

[3] For Skagit, the recovery escapement level is the escapement above which there is <1% probability that the unit will go extinct in 100 years, under existing conditions. The "recovery escapement level" should not be confused with the "recovery goal" (see recovery goals).

For those management units managed only by southern U.S. exploitation rate objectives (Western Strait, Elwha, Dungeness, Mid-Hood Canal) harvest now occurs predominantly outside of Washington waters, which constrains the scope of management effect that can be achieved in southern U.S. fisheries. Total exploitation rates have been stable at low levels in recent years, although variable due to internal Canadian conservation issues. In the near-term, these management actions are expected to continue in Canadian fisheries and maintain the levels of exploitation rates that have resulted in the current positive escapement trends for these units. For domestic management purposes, constraining fishery impacts to incidental levels is prudent. Establishment of southern U.S. exploitation rate objectives for these units provides certainty that U.S. impacts will be maintained at incidental levels, independent of increasingly restrictive northern fisheries.

Work is proceeding to develop management unit-specific analyses of recent productivity for the units managed under a recent-year or average of recent exploitation rates. Acquisition of data necessary for this analysis is a long-term process.

Recognizing the need to better understand the productivity of all management units, and to set harvest levels appropriately, the co-managers, nevertheless, assert that the proposed harvest objectives will protect Puget Sound chinook and not impede their recovery. Each of the fifteen management units identified is managed for sustainability, with management objectives reflective of current productivity levels. Viability of a given management unit will be assessed by abundance, productivity, spatial structure, and diversity considerations.

In the near term, viability relative to abundance and productivity will be gauged by spawning escapement. Progress toward recovery will be assessed against the current spawning escapement goals until management unit-specific recovery goals can be developed. These escapement goals were established to produce MSY, which by definition is viable in accordance with the Viable Salmonid Policy (McElhany et al. 2000). Currently, the majority of the management units have positive escapement trends and recent escapement levels above NMFS' "overfished" threshold. Four management units are routinely achieving their long-term spawning escapement goals – Hoko, Skokomish River, Puyallup River, and Green River.

The implementation of this approach preserves the existing diversity and spatial structure of natural populations within Puget Sound. These fifteen management units capture the full range of genetic diversity and life history traits exhibited by the natural chinook populations within Puget Sound. Each unit is being management independently for sustainability. The subset of Puget Sound chinook with completed management unit-specific productivity analysis (Skagit spring, Skagit summer/fall, Snohomish summer/fall, Stillaguamish summer/fall) and those routinely achieving their long-term spawning escapement goals represent a cross section of these life history traits and 75% of the natural production within Puget Sound (1992- 1996).

This management approach further enhances the probability of survival and recovery of Puget Sound chinook by being responsive to low stock status. Minimum spawning escapement levels have been established for each management unit and its associated populations. These low abundance thresholds are established to safeguard against declines to the point of stock instability. When spawning escapement is projected to fall at or below the low abundance thresholds, additional fisheries management measures are triggered to conserve these management units and associated population.

6 APPLICATION

Annual Planning

Harvest regime details are developed annually in the North of Cape Falcon process associated with the setting of harvest regimes for ocean fisheries under the Pacific Fisheries Management Council (PFMC) in March and April. The following steps will be used to determine whether a regime achieves conservation objectives for each management unit and obligations under the Pacific Salmon Treaty:

1. The managers will propose an initial fishing regime that considers forecasted abundance of chinook and other species, accesses harvestable abundance, and achieves allocation requirements.

2. This regime will be evaluated with accepted assessment models[4]. Model outputs will include, for each management unit, the expected exploitation rate, spawning escapement, and the southern U.S. non-ceiling index (PST). For this assessment, management unit-specific exploitation rate objectives will be converted into assessment model comparable values.

3. The expected exploitation rate for each management unit will be compared to its recovery exploitation rate (Table 6). If the expected exploitation rate exceeds the recovery exploitation rate, then fisheries will be adjusted as necessary (see Figure 4).

4. Fishing regimes will be further adjusted as necessary to fulfill PST requirements (See Appendix B).

5. If the modeled escapement for any management unit is lower than its low abundance threshold (Table 6), then southern U.S. fisheries will be adjusted until either

    a) the modeled escapement exceeds the low abundance threshold of the management unit in question,

    -or-

    b) the exploitation rate of the management unit is reduced to a level no greater than the Southern US exploitation rate defined by pre-season modeling of the regulation package listed in Appendix C.

6. The co-managers may agree to take additional conservation measures if their analysis demonstrates that such action will contribute significantly to stock recovery in concert with other specific habitat and enhancement actions.

A flow chart of the assessment procedure is contained in Figure 4.

[4] The model utilized will represent the latest progress in assessment modeling that has been jointly developed and agreed too by the co-managers (e.g., currently, this is the chinook FRAM).

There is no single fishing regime that will be used each year to achieve the management objectives, but there are a various measures that may be taken in any given year in each fishery that impacts Puget Sound chinook. Combinations of these actions will be applied in any given year, as necessary to insure that the combined impacts of all fisheries achieve the criteria listed above. Categories of restrictive measures to protect fish of concern and target harvestable fish include gear restrictions, time/area management, catch or retention restrictions (e.g., number, species, or marked fish), and complete closure of fisheries or portions thereof.

Management units with in-season updates will be identified within the annual Co-managers Fishery Management Plan for Puget Sound. Details regarding the in-season management plans for these management units will be defined in the annual harvest management plans.

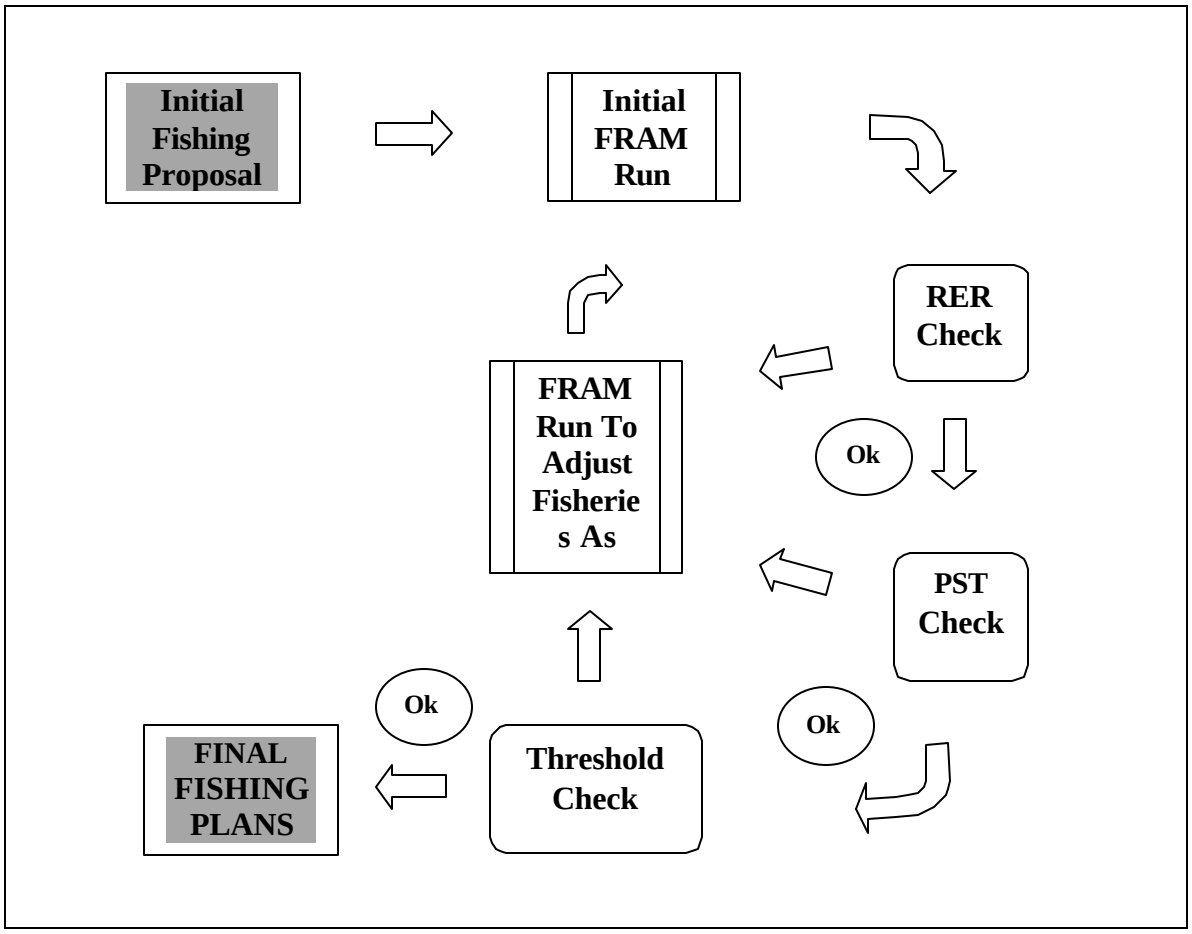

Figure 4. Flow Chart of Pre-Season Fishery Assessment Procedure.

Regulation Implementation

Each party is responsible for regulation of harvest in fisheries under its regulatory authority, consistent with the principles and procedures set forth in the Puget Sound

Salmon Management Plan. All fisheries shall be regulated to achieve sharing and production objectives based on four fundamental elements: (1) acceptably accurate determinations as to the appropriate exploitation rate, harvest rate, or numbers of fish available for harvest; (2) the ability to evaluate the effects of specific fishing regulations; (3) a means to monitor fishing activity in a sufficient, timely and accurate fashion; and (4) effective regulation of fisheries to meet objectives for spawning escapement and fishery impacts.

The annual Co-managers Fishery Management Plan provides a comprehensive summary of the fishing arrangements for treaty and non-treaty salmon fisheries in Puget Sound. The fishing arrangements contained within this document are based on pre-season expectations and, in some instances, may be modified on the basis of information obtained in-season and by agreement between parties. In-season modifications shall be in accordance to the procedures specified in the Puget Sound Salmon Management Plan and subsequent court orders.

Further details on fishery regulations may be found in the respective parties regulation summaries, in Status Reports as required by the Puget Sound Salmon Management Plan, and other State/Tribal understandings. The co-managers maintain a system for transmitting, cross-indexing and storing fishery regulations affecting harvest of salmon. Public notification of fishery regulations is achieved through press releases, regulation pamphlets, telephone hotlines, and federal register notices.

Monitoring

The co-managers assert that the effectiveness of fishery management regimes must be evaluated annually, to assess whether management objectives have been achieved. Within a broader context, the objectives themselves must be periodically examined to assure that they are meeting the conservation standards for each management unit, and the region as a whole.

The performance of fisheries will be assessed initially to determine the extent which catch and fishing effort conform to the quotas, ceilings, or projections that were defined in pre-season planning for each fishing area and season. Incidental and non-landed catch make up an important component of this accounting. This assessment leads to further evaluation of the effectiveness of fishery regulations, (i.e. time or area constraints, gear restrictions, or bag limits). The causes of significant discrepancies between expected and actual catch and effort will be identified with a view to changing regulatory measures, and methods for projecting catch and fishing effort, to improve their accuracy.

The annual abundance of chinook returning to each management unit will also be estimated to monitor the status of stocks and to assess the accuracy of forecasts. Terminal-area harvest and spawning escapement will provide the earliest hard evidence of unit abundance. The spawning escapement of each stock will be compared to the pre-season expectation, in most cases prior to planning the next fishing season. Assessment of the total annual return requires accurate estimation of escapement and reconstruction

of fishery mortality from coded-wire tag data or fishery simulation models. There will a time lag of approximately 18 months, after the conclusion of the fall fishing regime, before tag data are available. Tag recoveries from all intercepting fisheries – including those in Alaska, British Columbia - are required for this assessment. Accounting of the harvest mortality and escapement of each management unit will enable the calculation of exploitation rates, which may be compared with the pre-season projections and objectives. Ultimately, reconstruction of all cohorts associated with a given brood year enables the calculation of brood-year exploitation rates.

Cohort reconstruction and estimation of exploitation rates from tag data will also provide a means of assessing the accuracy of fishery simulation models. Models predict unit-specific mortality by scaling the abundance of all contributing stocks, and the fishing effort anticipated in each area and season, against those in a base period. Tag-based run reconstruction provides an alternative and independent estimate of the total harvest mortality and harvest distribution of each management unit. The errors detected in the simulation model, whether they be associated with abundance forecasts or computation of harvest, will be quantified so that fishery management planning will be robust to those errors.

Cohort reconstruction for each management unit is the fundamental monitor of productivity. As discussed above, the productivity (i.e. freshwater and marine survival) of each unit guides the development and adjustment of exploitation rate objectives. Those objectives must conform with the most recent values and trends in stock productivity. Periodically, the stock / recruit function will be updated, and the recovery exploitation rate and thresholds re-assessed, for each management unit.

The availability of requisite data, and the schedule for completing each aspect of monitoring harvest management effectiveness, are described in detail in Appendix D. Harvest monitoring and fishery sampling protocols are described there in the context of their application to management. The tasks involved in monitoring abundance and productivity, and assessing the performance of annual fishing regimes, are mandated by the Puget Sound Salmon Management Plan. This harvest plan only reiterates how the co-managers will follow that mandate, and provides specific information on how post-season assessments will feed information back into the annual fishery planning process.

Feedback and Annual Adjustment

State and tribal technical staff meet periodically during the year, exchange information and data, achieve consensus on in-season management actions, and prepare reports, consistent with the schedule in Appendix E. Additional meetings and exchanges will occur as needed to develop recommendations for management regimes pertinent to this plan, resolve differences in approach and review monitoring program results. Data from the monitoring programs form the basis for development and refinement of forecasting and assessment efforts.

Post-season review is part of the annual pre-season planning process. This post-season review is necessary to permit an assessment of the parties' annual management performance in achieving spawning escapement, enhancement, harvest, and allocation objectives. The co-managers review stock status annually and where needed, identify actions required to improve estimation procedures, and correct bias. If necessary, appropriate measures will be derived to address deleterious effects on size, age or sex selectivity. Such improvements provide greater assurance that objectives will be achieved in future seasons. This effort builds a remedial response into the pre-season planning process to prevent excessive fishing mortality levels relative to the conservation of a management unit. The format for the post-season report is shown in Appendix F.

Periodic review and revision of established goals are anticipated, as additional data becomes available for a management unit. In 2006, a formal review will occur of the complete harvest management plan and recovery goals for each management unit. The review of the harvest management plan will include, but not limited to population structure, recovery goals, management objectives, application, and monitoring. Revisions will occur if the comprehensive technical review of the available information indicates that such modification would benefit achieving the goals of the Plan.

7 INTEGRATION WITH ARTIFICIAL PRODUCTION

The intent of the tribal/state recovery effort is to protect remaining indigenous populations and restore chinook in watersheds capable of sustaining natural production (Tribal/State Hatchery Program Plan 2001). This approach seeks to maintain the historical patterns of genetic variability within spawning populations, as well as genetic diversity among populations.

The acceptable level of extinction risk for fishery management and hatchery activities varies with management unit. Within each river basin, recovery effort is based on maintaining genetic integrity and sustaining natural production. Each hatchery facility has identified production strategies and operational protocols to obtain this objective (Tribal/State Hatchery Program Plan 2000). Emphasis is placed on existing indigenous populations and the watershed's ability to sustain natural populations. The structuring of recovery efforts regarding fishery management and hatchery practices are focused on these areas where habitat can still sustain natural production and the persistence of indigenous populations. This can be broken down into three categories:

> Category 1: Protect and recover genetically unique indigenous populations in watersheds where they still occur.
>
> Category 2: Implement management action that use the most locally adapted stock to re-establish and sustain natural production in watersheds that no longer have indigenous populations, but where natural production is possible given existence of suitable or productive habitat.

> Category 3: Watersheds that have not historically supported self-sustaining natural chinook salmon populations will not be required to have specific objectives for recovering chinook salmon.

Watersheds that contain indigenous populations are the focus of initial management emphasis, and fishery management is focused on natural production. Assessment of hatchery programs and practices are focused at the SASSI "stock"[5] level given the nature of their potential impact within the watershed and among the natural population present. Fishery management actions are assessed at the management unit level with consideration given to the objectives concerning the individual populations.

Maintaining genetic diversity and integrity of these populations and achieving abundance levels for long-term sustainability is the highest priority for their associated management units. Nineteen populations have been identified in this category in the Puget Sound region (Table 7). Within Table 7, the left-hand column presents the category classification for each SASSI stock and the right-hand column presents the associated management unit and its management emphasis. All Category I populations are within natural management units that upon recovery will be managed for maximum sustainable yield. In recent years (1992-1996), these management units have represented over 69 percent of the total natural production from within Puget Sound.

The approach taken on watersheds classified as Category II depends on the analysis of appropriate available populations and existence of suitable or productive habitat. To achieve long-term sustainability, the existing habitat must be protected and enhanced. Within these watersheds harvest and hatchery strategies are structured to promote and maintain the abundance needed to sustain natural production. The management plans are being structured with the intent to promote natural origin recruits to perpetuate the natural run. However, where certain hatchery programs have been implemented specifically as mitigation for significant losses of natural production potential, the intent may be to maintain a composite natural/hatchery population until there is adequate habitat recovery.

Category III watersheds have never had independent, self-sustaining populations. Many of these watersheds do not have morphological characteristics (e.g., flow, channel width, gravel type) needed to sustain chinook salmon. Chinook in these watersheds are largely the result of hatchery outplants and strays. The focus on recovery in these areas will be directed towards habitat protection to ensure maximizing fish productivity. Any production of chinook salmon from these tributaries is welcome, but incidental to the state and tribal recovery goals.

Application of this approach is intended to enhance the diversity of natural chinook populations within Puget Sound. The categories establish the protocols for artificial production activities within each river basin to maintain and promote diversity. Review of Category I populations, reveals indigenous stocks possess a wide temporal and spatial distribution within Puget Sound (Figure 5). The addition of Category II populations

[5] Supra –See footnote 1.

bolsters diversity and the spatial and temporal distribution of natural chinook production from within the region.

Table 7 - Puget Sound Matrix - SASSI Stocks Recovery Category/Natural Management Units

River Basin - SASSI Stocks - Recovery Category		**Natural Management Unit** - Populations - Management Intent*	
Nooksack/Samish		**Nooksack Early**	
- NF Nooksack	1	- NF Nooksack	MSY
- SF Nooksack	1	- SF Nooksack	Management
- Samish/MS Nooksack Fall	non-native		
Skagit		**Skagit Spring**	
- Upper Sauk Spring	1	- Upper Sauk	MSY
- Suiattle Spring	1	- Suiattle	Management
- Upper Cascade Spring	1	- Upper Cascade	
- Lower Sauk Summer	1	**Skagit Summer/Fall**	
- Upper Skagit MS/Tribs. Sum.	1	- Lower Sauk summer	MSY
- Lower Skagit MS/Tribs. Fall	1	- Upper Skagit summer	Management
		- Lower Skagit fall	
Stillaguamish		**Stillaguamish Summer/Fall**	
- Stillaguamish Summer	1	- Stillaguamish sum.	MSY
- Stillaguamish Fall	1	- Stillaguamish fall	Management
Snohomish		**Snohomish Summer/Fall**	
- Snohomish Summer	1	- Snohomish sum.	MSY
- Wallace R. Summer/Fall	1?	- Wallace R. sum/fall	Management
- Snohomish Fall	1	- Snohomish fall	
- Bridal Veil Cr. Fall	1	- Bridal Veil Cr. Fall	
Lake Washington		**Lake Washington Sum/Fall**	
- N Lake Washington Tribs.	2	- N. Lake Wash. Tribs.	MSY
- Cedar River	1	- Cedar River	Management
- Issaquah	Non-native		
Duwamish/Green		**Green Summer/Fall**	
- Duwamish/Green	1	- Green	MSY
- Newaukum Creek	= Green R.	- Newaukum Creek	Management
Puyallup		**White River Spring**	MSY Mgmt.
- White River Spring	1	- White R. spring	
- White (Puyallup) Summer/Fall	2	**Puyallup**	Sustain Natural
- Puyallup Fall	2	- Puyallup	Production
Nisqually		**Nisqually**	Sustain Natural
- Nisqually Summer/Fall	2	- Nisqually	Production
South Sound Tributaries	3	* *See Footnote	
Hood Canal		**Mid-Hood Canal**	MSY
- Hood Canal Summer/Fall	2	- Dosewallips	Management
		- Duckabush	
		- Hamma Hamma	Sustain Natural
		Skokomish	and Mitigative
		- Skokomish nat/hat	Production
Strait of Juan de Fuca		**Dungeness**	Supplemented
- Dungenes s Spring /Summer	1		Recovery
- Elwha/Morse Cr. Summer/Fall	1	**Elwha**	Maintenance for
- Hoko Fall	1		Restoration
		Western Strait	MSY
		- Hoko	Management

* MSY management seeks to maximize natural capability and sustain natural production seeks to maintain a natural population at a specified level within a river basin.

** No historical evidence suggests that sustainable chinook salmon production occurred in these systems. Current production is assumed to origin from off station plants and hatchery strays.

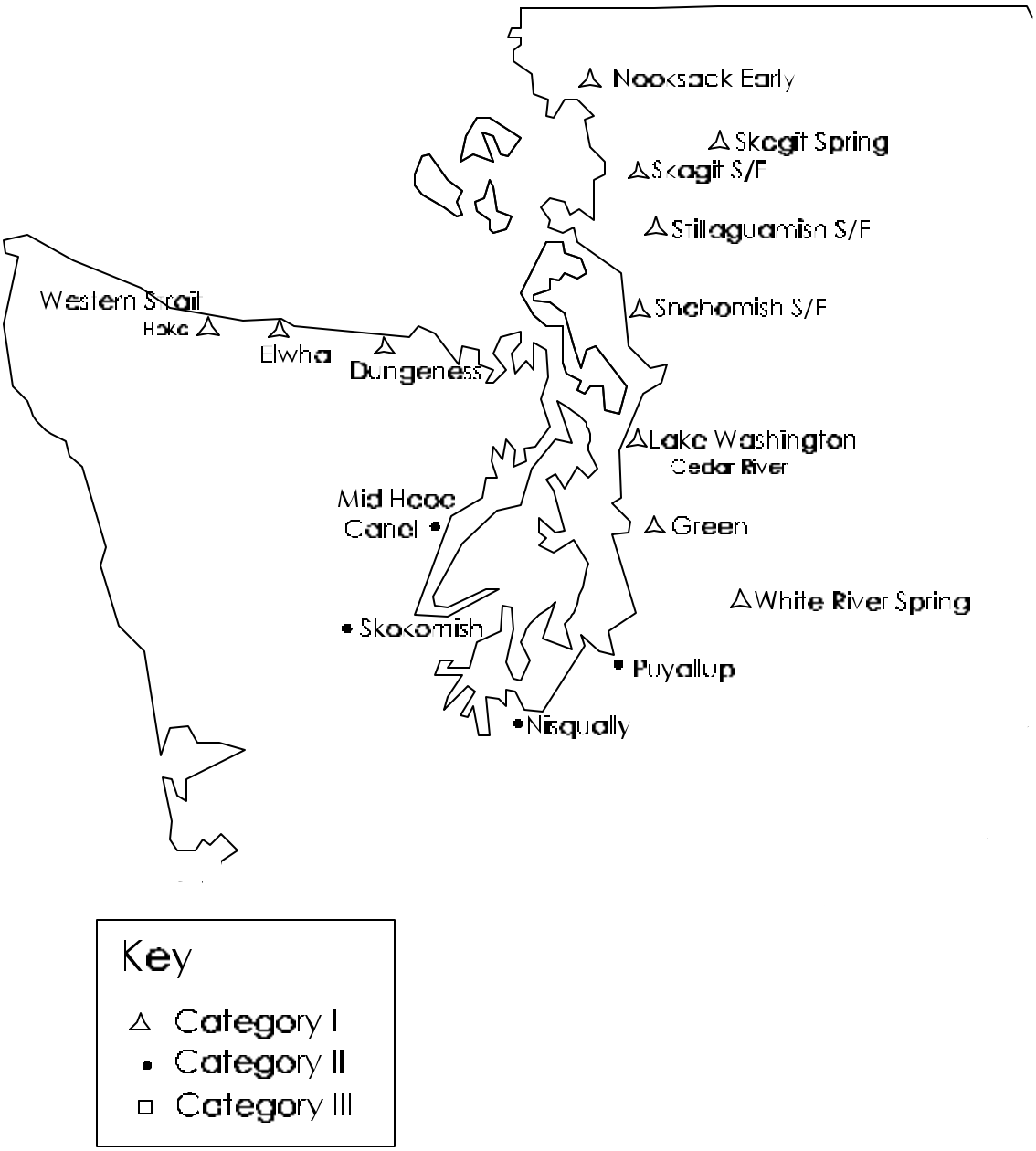

Figure 5. Puget Sound Chinook Management Units and Hatchery Category Assessment.

8 INTEGRATION WITH WATERSHED PLANS

The overall recovery approach addresses harvest, hatchery practices, habitat protection, and enhancement issues. The harvest and hatchery strategies work in unison to protect, promote, and sustain natural production of chinook within Puget Sound. The harvest management plan specifies stock-specific objectives for each natural management unit and the associated hatchery plan indicates how production activities within the watershed comply with these goals. There are also watershed recovery plans that apply to each separate basin in Puget Sound (Table 8). The watershed recovery plans outline the specific management, hatchery, and habitat actions required to recover these stocks to their fullest capacity, productivity, and abundance. Each watershed plan outlines the recovery actions necessary to restore the ecological processes within the given river system, and to address issues pertaining to harvest management, hatchery production/supplementation, habitat restoration, predation/prey competition, and inter-species interactions. This plan integrates with the watershed plans by ensuring that harvest related mortality does not impede recovery of chinook salmon within Puget Sound, while rehabilitation of natural process can occur.

Each watershed plan outlines the recovery actions necessary to restore the physical and ecological processes with the given basin. The general environmental issues confronting Puget Sound chinook have been addressed in the state and tribal co-managers' report covering habitat factors for decline (Morgan 2000). These watershed plans provide in more detail the environmental and management issues at work within the basins then covered previously in an earlier summary of critical habitat issues (Bishop and Morgan 1996).

These plans utilize existing watershed analyses and results of on-going limiting factor assessment to identify potential habitat problems. Limiting factor analyses are being conducted for each major watershed within Washington State (Washington State Conservation Commission 2000). Each watershed is being assessed for the conditions that limit the ability of habitat to fully sustain populations of salmon. These factors are primarily fish passage barriers, degraded estuarine area, riparian corridors, stream channels and wetlands. Results from these assessments will aid in prioritizing recovery efforts within each watershed.

9 PLAN IMPLEMENTATION

The harvest management plan has been developed jointly between the Puget Sound treaty tribes and Washington Department of Fish and Wildlife, these respective entities have direct management authority over fisheries harvesting Puget Sound chinook in Puget Sound. Formal action will be taken to update the existing management unit-specific management goals and conservation objectives upon completion of the comprehensive technical review regarding the reassessment of MSY goals. In the interim, the co-managers will submit the recovery exploitation rate objectives for the Puget Sound chinook management units to the Pacific Fishery Management Council for inclusion into the annual federal management plan for West Coast salmon.

The ocean salmon fisheries in the exclusive economic zone (EEZ) off Washington, Oregon, and California are managed under authority of the Magnuson-Stevens Act. Annual management recommendations are developed according the "Pacific Coast Salmon Plan" (FMP) of the Pacific Fishery Management Council (PFMC 1999). The

Table 8 – Summary of Individual Watershed Recovery Plans as of January 2001.

Watershed	Report Title	Status	Contact Agency
Western Strait of Juan de Fuca		No reports in progress	
Elwha River		Report in progress	
Dungeness River	1)Dungeness-Quilcene Water Resources Mgmt. Plan 2)Recommended Restoration Projects for the Dungeness R. 3)Dungeness R. Chinook Salmon Rebuilding Project Progress Report	1)complete 2)complete 3)complete	1)Jamestown S'Klallam Tribe 2)Jamestown S'Klallam Tribe 3)WDFW
Mid-Hood Canal		No reports in process	
Skokomish River		No reports in process	
Nooksack River		Report in progress	Lummi Tribe Nooksack Tribe
Skagit River	The Skagit Chinook Restoration Plan	Draft	Skagit System Co-operative or WDFW
Stillaguamish River	Technical Assessment and Recommendations for Chinook Salmon Recovery in the Stillaguamish Watershed	Complete	Stillaguamish Tribal Natural Resources or Snohomish County Surface Water Management
Snohomish River	Initial Snohomish River Basin Chinook Salmon Conservation/Recovery Technical Workplan	Complete	Snohomish County Surface Water Management
Lake Washington	Lake Washington Chinook Salmon Recovery Plan	Draft	Muckleshoot Tribe or WDFW
Green River	Green River Chinook Recovery Plan	Draft	Muckleshoot Tribe, WDFW
White River Spring	White River Spring Chinook Recovery Plan	Complete	Muckleshoot and Puyallup Tribes; WDFW

Puyallup River	Puyallup River Fall Chinook Recovery Plan	Draft	Puyallup Tribe, WDFW
Nisqually River	Nisqually Basin Fall Chinook Recovery Plan	Draft	Nisqually Tribe

Pacific Fishery Management Council provides its management recommendations to the Secretary of Commerce, who implements the measures in the EEZ if they are found to be consistent with the Magnuson-Stevens Act and other applicable law.

The Pacific Coast Salmon Plan provides for the modification of annual management objectives for salmon stocks managed under federal court order, such as Puget Sound chinook. Consequently, the treaty tribes and WDFW may agree to annual targets that differ from the current MSY conservation objectives identified in the FMP for Puget Sound chinook management units.

Puget Sound fisheries are managed by the State of Washington and the Puget Sound treaty tribes pursuant to the Puget Sound Salmon Management Plan (PSSMP) which was adopted by court order as a sub-proceeding related to U.S. v. Washington (384 F. Supp. 312 (W. D. WASH. 1974)). The purpose of the PSSMP is to establish guidelines for management of salmon and steelhead resources originating in Puget Sound. The PSSMP applies to all marine and freshwater fisheries in Puget Sound from the Strait of Juan de Fuca eastward. The plan also allows for annual deviation from the established stated goal, by agreement of the co-managers for the associated management unit. Formal action will be taken to revise the management guidelines within the PSSMP upon completion of the reassessment of the MSY estimates or goals.

The core elements of the harvest plan and its associated enforcement and monitoring efforts are conducted under existing fishery management programs. Funding levels for these programs have fluctuated over the years as with all state and federal natural resource oriented programs. Each management entity is committed and focused on maintaining funding levels for these core programs.

Additional funding is being sought and would directly affect the development of certain aspects of the Comprehensive Chinook Management Plan and its harvest management component. Current work on the harvest plan is occurring under core program funding. However, additional funds would accelerate development and increase coverage of monitoring and assessment efforts (e.g. expanded spawning ground surveys and smolt enumeration sampling).

10 FUTURE RESEARCH AND DATA NEEDS

The co-managers expect this chinook management framework will evolve over the short and long-term, improving to the extent that technical shortcomings are addressed. Several technical tasks have been identified as necessary to improving the framework over the next two to five years.

- Evaluate and develop MSY escapement goals and exploitation rates for all Puget Sound management units.
- Evaluate the low abundance or spawning escapement thresholds for all Puget Sound management units.
- Acquire age composition and sex ratio data for all Puget Sound management units.
- Assess the extent to which hatchery-origin spawners contribute to natural spawning escapement estimates and the extent natural-origin spawners contribute to hatchery rack escapement.
- Expand monitoring program for smolt production to track the relative trends in fresh water survival for all Puget Sound management units.
- Improve the chinook indicator stock programs to provide data used to estimate productivity and survival of natural stocks and to estimate MSY spawning escapement goals and exploitation rates.
- Conduct genetic analyses of natural-spawning chinook to determine the extent to which unique stocks persist in streams such as the Puyallup River, the Nisqually River, and Hood Canal streams. This kind of investigative work will lead to an evaluation of the viability of natural stocks and determination of what natural stocks might best be utilized for supplementation programs.
- Improve estimates of non-landed mortality.
- Develop and evaluate methods for fishing selectively for appropriate hatchery-origin stock, including time-and-area management strategies and selective retention regulations consistent with co-managers policies and management obligations.
- Improve precision and accuracy of modeling capability.
- Conduct analysis of harvest regulations for existence of size or sex selectivity and extent of potential impact.

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12 GLOSSARY

Abundance - Abundance is the measure of the size of the population or a component of the population. For habitat of constant quality, abundance is positively correlated with the quantity of the habitat. Abundance goals are expressed as numeric life stage targets reflective of the capacity of the associated ecosystem. In general, abundance may be expressed in terms of brood year (the offspring of parents that spawned during a single year) or return year (the individuals maturing and returning to spawn in a single year).

Adult Equivalents (AEQ) - The potential contribution of fish of a given age to the spawning escapement, in the absence of fishing. Because not all unharvested fish will survive to contribute to spawning escapement, a two-year-old chinook has a lower probability of surviving to spawn, in the absence of fishing, than does a five-year-old. Therefore, these two age classes have different "adult equivalents".

Adult Fish - a salmonid that would spawn in the current year absent fishing or natural mortality.

Affected Party - A party who believes its interests will be affected by a proposed action under this plan. [see **Parties**]

Allocation Unit - A management unit or aggregated group of management units for which harvest shares are calculated. [see also **Management Unit**]

Base Period - A set of years used as an information basis to assess present or proposed actions. For example, exploitation rates on specific chinook stocks may be required to be z% lower than those achieved in a **xx-yy** base period.

Catch Ceiling - A fishery catch limitation expressed in numbers of fish. A ceiling fishery is managed so as not to exceed the ceiling. A ceiling is not an entitlement. [see also **catch quota**]

Catch Quota - A fishery catch allocation expressed in numbers of fish. A quota fishery is managed to catch the quota; actual catch may be slightly above or below the quota. Usually a quota is treated as an entitlement in that deviations may result in adjustments in subsequent years. [see also **catch ceiling**]

Cohort Analysis - A sequential population analysis technique used to reconstruct the population size during earlier time periods.

Cohort Size (initial) - The total number of fish of a given age and stock at the beginning of a particular year of life.

Coded-Wire Tag (CWT) - Coded microtags that are implanted in juvenile salmon prior to release. Fisheries and escapements are sampled for tagged fish. When recovered, the

binary code on the tag provides specific information about the individual's tag group (e.g., location and timing of release, special hatchery treatments).

Conservation – This term is used in the general sense such as to foster or maintain and not in the legal context within this document.

Diversity - Diversity is the measure of the heterogeneity of the population, in terms of the life history, size, timing, and age structure. It is positively correlated with the complexity and connectivity of the habitat. Diversity goals are expressed as desirable population characteristics.

Dropoff Mortality - The fraction of salmon encountered by a particular gear type that "drop-off" before they are landed, and die from their injuries prior to harvest or spawning.

Escapement - The portion of a run that returns to natural or artificial spawning areas.

Evaluation Fishery - A full fleet fishery from which technical or management information is obtained.

Exploitation Rate (ER) - Total mortality in a fishery expressed as the fraction of the potential escapement removed due to the fishery.

Extreme Terminal Fishery – A fishery in freshwater, or one that harvests primarily fish from a single management unit.

Fishery – The harvest of salmon by a specified gear type in a specified geographical area during a specified period of time.

FRAM - The Fishery Regulation Assessment Model is a simulation model developed for use in estimating the impacts of Pacific Coast fisheries on chinook and coho stocks.

Harvest Rate (HR) - Total fishing mortality in a fishery expressed as a proportion of the total fish abundance available (standing stock) in a given fishing area at the start of a time period.

Landed Catch – Harvested fish that are taken aboard vessels or shore and retained by fishers. [see also **Nonlanded Catch**]

Low Abundance Threshold - A spawning escapement level below which the co-managers will exercise maximum regulatory effect to minimize fishery related impacts and maximize spawning escapement.

Management Period - The time interval during which regulatory actions are directly based on the management objectives for a management unit or allocation requirement for an allocation unit, taking into account catches (actual or expected) of the unit(s) outside

its management period. Management periods are specific to each combination of management unit and fishery. [see also **Management Unit**]

Management Unit - A stock or group of stocks which are aggregated for the purpose of achieving a management objective.

Maximum Sustainable Harvest (MSH) - The maximum number of fish of a management unit that can be harvested on a sustained basis, measured as adult equivalents. In the Puget Sound Salmon Management Plan, MSH is defined as maximum sustainable harvest to Washington fisheries. [see **Adult Equivalent**]

MSY Exploitation Rate – The Maximum Sustainable Yield (MSY) exploitation rate is the proportion of the stock (computed as the sum of all fishing mortality, measured in adult equivalent terms and escapement) that could be harvested if long-term yield was to be maximized. The MSY exploitation rate is typically computed assuming stable stock productivity, although annual variability may occur.

Natural Spawning Area - An area which is or may be utilized by spawning salmon and in which egg deposition, fertilization, and rearing occur naturally.

Non-landed Catch - This category of fishery-related mortality includes drop-off mortality, and all other sources of fishery-related mortality that are not included in landed catch. Also referenced to as non-landed mortality. [see **Landed Catch**]

Non-treaty Fisheries - All fisheries that are not treaty Indian fisheries. [see **Treaty Fisheries**]

North of Cape Falcon – A regional management coordination pre-season planning forum. This process is a series of public meetings, usually two, which occur between the March and April Pacific Fishery Management Council meetings. Due to the migratory nature of chinook and coho salmon, these meetings provide for an opportunity for discussion, analysis and negotiation among management entities with authority over southern US fisheries.

Parties - The state and the 17 Puget Sound tribes together make up the parties to this plan.

Pre-terminal Fishery - A fishery that harvests significant numbers of fish from more than one region of origin.

Productivity - Productivity is the measure of the survival rate of the population from one life stage to another is measured after taking into consideration mortality occurring during that period. It is positively correlated to the quality of the environment. Productivity goals are expressed as survival rates by individual life stages in order to evaluate productivity in different habitat types and accommodate available data.

PSC Escapement Threshold – An interim escapement threshold set at 85 percent of the management unit's MSY production under average environmental conditions. This level represents the interim weak stock gate or lower escapement bound for taking additional management action pursuant to the chinook annex within the US/Canada Pacific Salmon Treaty.

Region of Origin - A geographic area from which an allocation unit originates. The following geographic areas are recognized regions of origin:

1. Washington coastal (each river is a separate unit)
2. Strait of Juan de Fuca (each river is a separate unit)
3. Nooksack - Samish Rivers
4. Skagit River
5. Stillaguamish-Snohomish Rivers
6. South Puget Sound, south of the Snohomish System
7. Hood Canal
8. Other U. S. regions (aggregated)
9. Canada (aggregated)

Run - A stock or group of stocks identified for fishery management purposes.

Run Size - The number of fish in an allocation unit, management unit, stock or any aggregation thereof.

Salmon - the following anadromous species of the family Salmonidae which are native to the United States v. Washington Case Area:

Oncorhynchus tshawytscha (chinook, king, spring, tyee, blackmouth salmon)
Oncorhynchus kisutch (coho, silver, silverside, hooknose salmon)
Oncorhynchus nerka (sockeye, red, blueback salmon)
Oncorhynchus keta (chum, calico, dog, keta salmon)
Oncorhynchus gorbuscha (pink, humpback, humpy salmon)
Oncorhynchus mykiss (Steelhead)

Shaker Mortality - A type of nonlanded mortality. [see **Nonlanded Mortality**]

Southern US Non-Ceiling Index – The index compares the expected AEQ mortalities (assuming base period exploitation rates and current abundance) with the observed AEQ mortalities, by calendar year, over all non-ceiling fisheries in southern US. This index originates from the passthrough provision of the Pacific Salmon Treaty.

Spawners – Equivalent to **escapement**.

State - The State of Washington and all the agencies of its government.

Stock - An anadromous salmonid population of a single species migrating during a particular season to a specific fish production facility and/or to a freshwater system which flows into saltwater.

Terminal Fishery - A fishery harvesting primarily fish from a single region of origin, but may include more than one management unit.

Test Fishery - An agreed-upon fishery conducted on a limited basis for the purpose of acquiring technical or management information. Any fish taken in test fisheries may not be sold for personal profit.

Treaty Fisheries - Fisheries authorized by tribes possessing rights to do so under the Stevens treaties. [see also **Nontreaty Fisheries**]

Tribes - All Puget Sound treaty tribes: Lummi, Nooksack, Suquamish, Swinomish, Upper Skagit, Sauk-Suiattle, Tulalip, Stillaguamish, Muckleshoot, Puyallup, Nisqually, Squaxin Island, Skokomish, Port Gamble S'Klallam, Jamestown S'Klallam, Lower Elwha Klallam, and Makah.